The electron and proton of a hydrogen atom are separated (on the average) by a distance of approximately 5.3E-11 m. Find the magnitudes of the electric force and the gravitational force between the two particles. The mass of an electron is 9.11E-31 kg, and the mass of a proton is 1.67E-27.

$|q_e| = 1.602E-19\ C$

$$F_e = \frac{k_e |q_e||q_p|}{r^2}$$

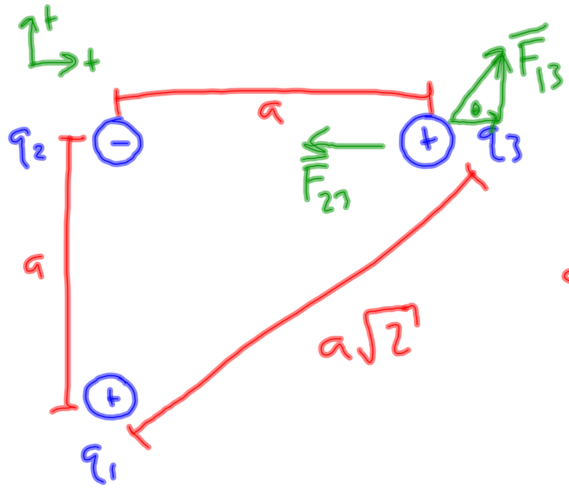
$$= 8.21E-8\ N$$

$$F_g = \frac{G m_e m_p}{r^2}$$

$$= 3.6E-47\ N$$

Electrostatics Notes and Practice Problems 11.4.11 AP Physics

Consider three point charges located at the corners of a right triangle as shown in the figure below. Find the resultant force exerted on q_3.



$\theta = 45°$

$a = 0.10\ m$

$q_1 = q_3 = 5\ \mu C$

$q_2 = -2\ \mu C$

$$\Sigma \bar{F}_x = \bar{F}_{23} + \bar{F}_{13x}$$

$$\bar{F}_{13x} = \bar{F}_{13}\cos(45°)$$

$$= \frac{-k|q_2||q_3|}{r_{23}^2} + \frac{k|q_1||q_3|}{r_{13}^2}\cos(45°)$$

$$= -9.0\ N + 7.9\ N$$

$$= -1.1\ N$$

$$\Sigma \bar{F}_y = \bar{F}_{13y}$$

$$= \bar{F}_{13}\sin(45°) = \frac{k|q_1||q_3|}{r_{13}^2}\sin(45°)$$

$$= 7.9\ N$$

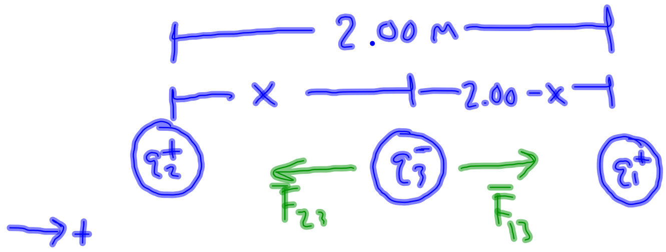
$\bar{F} = 7.97\ N$

$\theta = 82°$

N of W

Electrostatics Notes and Practice Problems 11.4.11 AP Physics

Three point charges lie along the x-axis as shown below. The positive charge q_1 = 15.0 microC is at x = 2.00 m, the positive charge q_2 = 6.00 microC is at the origin, and the net force acting on q_3 is zero. What is the x-coordinate of q_3?



$$\Sigma \bar{F}_3 = -F_{23} + F_{13} = 0$$

$$-\frac{\cancel{k}|q_2|\cancel{|q_3|}}{x^2} + \frac{\cancel{k}|q_1|\cancel{|q_3|}}{(2-x)^2} = 0$$

$$\frac{q_2}{x^2} = \frac{q_1}{(2-x)^2}$$

$$q_2(2-x)^2 = q_1 x^2$$

$$q_2(4-4x+x^2) - q_1 x^2 = 0$$

$$(q_2-q_1)x^2 - 4q_2 x + 4q_2 = 0$$

$$[(6E{-}6\ C) - (15E{-}6\ C)]x^2 - 4(6E{-}6\ C)x + 4(6E{-}6) = 0$$

$$3x^2 + 8x - 8 = 0$$

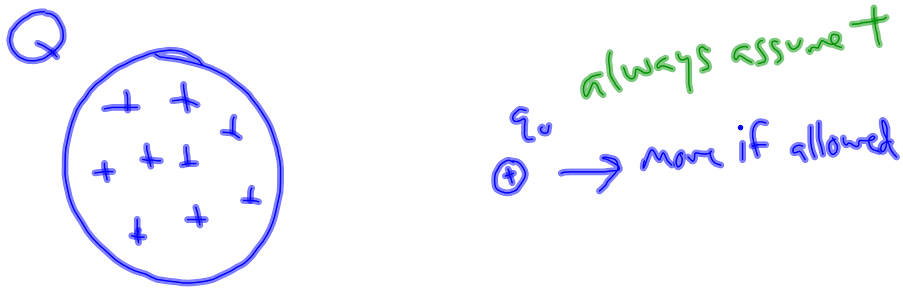
$$x = 0.775\ m$$

~~$x = -3.44$ m~~

Electric Field:

- Around every charged object is an electric field.

- To measure, we use something called a test charge.
  - ↳ charge that is small in comparison to charge we care about



$$\overline{E} = \frac{\overline{F_e}}{q_0}$$

$\overline{F_e}$ → electric force

q_0 → test charge

↳ $\overline{E}$: electric field

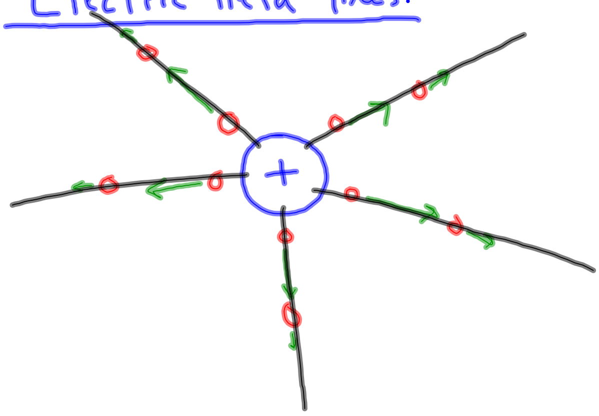
Units for E are $\frac{N}{C}$

... rearranged

$$\overline{F_e} = q_0 \overline{E}$$

$$\overline{E} = \frac{\overline{F_e}}{q_0} = \frac{\frac{k q_0 q}{r^2}}{q_0} = \frac{kq}{r^2}$$

Electric field lines:



- lines never overlap
- for + charge, arrows point outwards.
  for − charge, arrows point inwards.
- we can draw an infinite # of lines, but minimum = 3.